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REPTILES

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Cover: A young king snake emerging from its shell.

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REPTILES

VERNE N. ROCKCASTLE

To many people no animal is more loathsome than the snake. No animal is so commonly mistaken for an entirely different group of vertebrates than the lizard. No other vertebrate has the peculiar protective armor of the turtle. All three of these animals—snake, lizard, and turtle—are reptiles, one of the most fascinating but least understood and appreciated groups of vertebrates.

Perhaps the earliest accounts of serpents in myth, in legend, and in the Bible have helped to make serpents synonymous with evil. In at least one recent children's book on reptiles, the only pictures of snakes are those of poisonous ones, giving the impression that all snakes are harmful. In a nature movie produced by a major educational enterprise, the musical accompaniment quickly becomes sinister sounding whenever a snake appears. Children soon become accustomed to the idea that snakes are harmful and that jungles must be full of creeping, crawling, poisonous creatures. Within thirty-five miles of New York City poisonous snakes are numerous, yet you probably would have difficulty finding a single one even if you looked for it. On the other hand, you can see numerous harmless snakes on a summer day in almost any part of New York State.

Many persons believe that snakes are slimy, that they sting with their tongues or their tails, that they charm birds, that milk snakes steal milk from cows, that all snakes that live in water are moccasins, that lizards are poisonous, and that alligators eat people. As you read this Leaflet and the references at the back, and as you study reptiles, you may learn to appreciate them fully. When you do, you will find them to be one of the most interesting animal groups of all.

WHAT IS A REPTILE?

A reptile is similar to a fish, a frog, a bird and a dog only because it has a skeleton. It does have a few of the characteristics of fishes, and some of amphibians, but a study of reptiles wil soon show you that they have distinct features that are not shared by other animals.

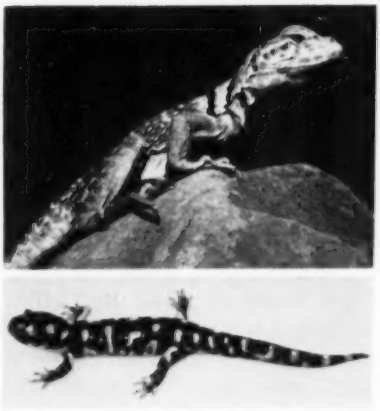
Reptiles have scales like fishes, but their skins are dry, not slimy. If snakes seem slimy it is only because their skins are glassy smooth.

There are no slime glands in the skins of reptiles.

Reptiles breathe with lungs. Even those that live in water must come up for air. Some may stay under the water for a long time, and may even hibernate under water, but they have no gills as young salamanders and all of our native fishes do.

Reptiles are cold-blooded animals. This does not mean that their blood is cold. It means that reptiles cannot keep their blood temperature constant as we do. When a reptile is in a cold environment, its temperature approximates that of its surroundings. Then the animal is in the hot sun, its temperature rises considerably. Temperature is a critical factor in the survival of reptiles. Because reptiles are cold-blooded, they are never found in arctic regions because they cannot keep warm enough to live in such a cold environment. They are also susceptible to extreme heat; desert reptiles are often nocturnal, moving about for food only after the sun goes down and the desert begins to cool.

Some reptiles bear their young alive, but many lay eggs. Unlike amphibians, reptiles always lay their eggs on land. Their eggs have shells that are tough membranes rather than brittle shells like birds' eggs. Reptiles' eggs are nearly always white or creamy colored. They are never brightly colored or mottled as some birds' eggs are.



How many differences can you see between this collared lizard and the tiger salamander? The lizard is from the Southwest; the salamander is from New York State.

Many reptiles have no legs, but those that do have claws at the tips of their toes. Amphibians do not have claws. The scaly skin, the claws, the lack of gills, and the leathery eggs all help to distinguish reptiles from amphibians.

Scientists have classified reptiles into major groups called orders. The snakes represent one order of reptiles, lizards are another, and turtles are a third. Crocodiles and alligators are not lizards, but form a fourth order of reptiles. A fifth order contains some of the weird lizard-like reptiles that inhabit the islands of southeastern Asia, but only the first four orders are represented in the United States. This Leaflet will describe some snakes, lizards, and turtles, but will not deal with alligators and crocodiles.

SNAKES

CHARACTERISTICS

Skin

The skin of a snake is a sort of coat of mail. It is transparent like cellophane and fairly strong, too. The scales on the back are small and overlap each other like shingles on a roof. A transparent outer skin covers these scales in a single, thin piece. In most snakes the scales of the belly are long and narrow, extending across from one side to the other. Back of the anus, the scales are usually double instead of long, single ones. Hold a small, harmless snake such as a green snake and examine its scales carefully. Can you see that scales cover the head as well as the body? Can you find the vent (anus) where a double row of belly scales begins? The tail begins at this point.

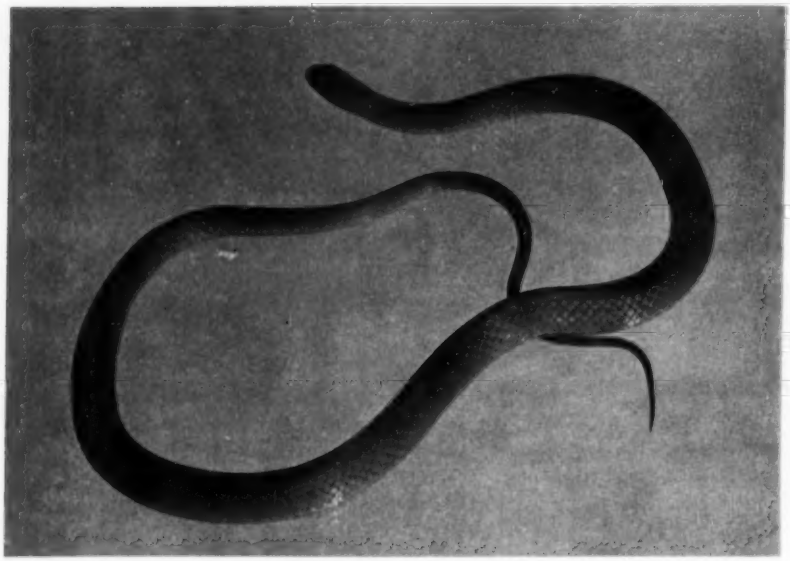
When a snake sheds its skin, its eyes turn milky-blue, and the snake cannot see well. For that reason, it may be nervous and inclined to strike at disturbing objects. In a few days, the skin loosens along the jaws, and the snake literally crawls out of its skin. The old skin is turned inside out as the snake crawls from it. Often the snake will rub against a rough surface such as a stone, a slab of bark, or it will crawl through a narrow space in a effort to free itself from the old skin. Save a discarded snake skin for study. Examine it to see the pattern of the scales. Can you find the part of the skin that covered the eyes?

Salamanders often eat their skins soon after shedding them, but snakes do not. They just crawl out of the old skin and go on their way. Curiously enough, a bird called the crested flycatcher almost always uses a snake skin in the building of its nest. If you find a nest with a snake skin in it, you may be fairly sure that you have found a crested flycatcher's nest. Why the bird developed this peculiar habit is an unanswered question.

After a snake has shed its skin, it has room to grow comfortably for a while. When the new skin becomes too tight, it has to be shed again. A snake usually sheds its skin several times during a single year.

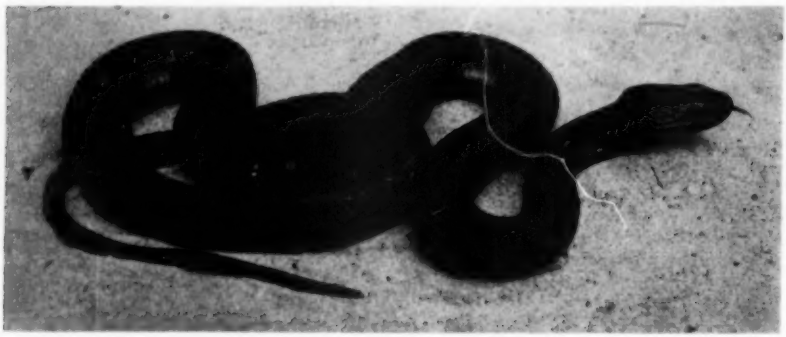
The rattlesnake sheds its skin like other snakes, except that when the shed skin reaches the tail, a

The larger skin was shed by a garter snake. The smaller, fine-scaled one is from a western rubber boa. Can you see the large belly scales on the garter snake skin?



The smooth green snake is one of the most beautiful of the eastern snakes, and one of the gentlest. It has smooth scales.

piece of it remains. This piece is merely a loose knob of dried skin that rattles when the tail vibrates. Since each rattle is formed when the skin is shed, they do not tell how old the snake is, but only how many times it has shed its skin. Rattles may break off, too, so the



Keeled scales, such as those on this water snake, usually are found on snakes that bear living young.

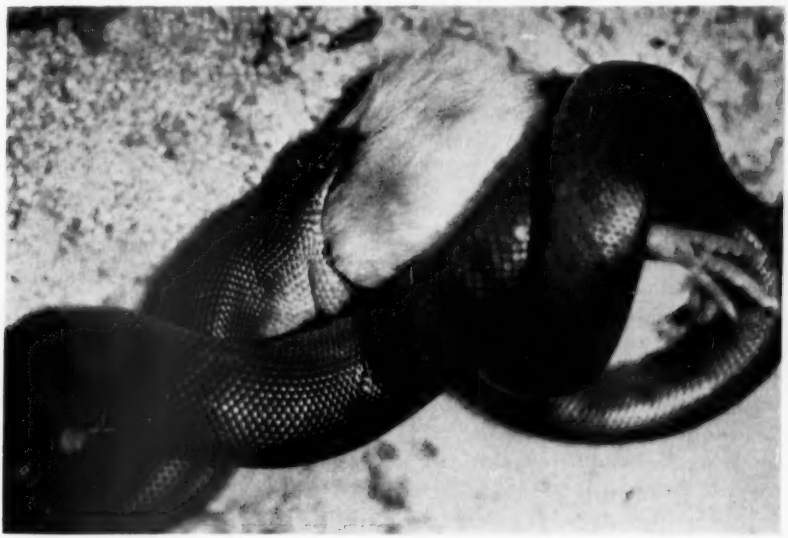
number remaining does not always indicate the number of times the skin is shed.

The scaly skins of snakes are so smooth that they sometimes feel glassy or slippery. Since a snake has no slime glands, a moist skin means only that the snake was in a damp or wet place. Some snakes, such as the garter snake, produce a foul smelling substance from glands just inside the anus. Although this unpleasant stuff may be smeared on the fingers of a person picking up the snake, it does not come from the snake's skin.

Some snakes have smooth scales, but others have a tiny, lengthwise ridge on each scale. Garter snakes, for example, have these *keeled* scales. Water snakes, hog-nosed snakes, rough green snakes, and red-bellied snakes and all rattlesnakes have keeled scales. Milk snakes and other king snakes, the racers, and the smooth green snake have smooth scales. Snakes that have smooth scales appear to be shinier or more satiny than those with keeled scales. Most of the snakes that have keeled scales produce living young. Most of the smooth-scaled snakes lay eggs.

Jaws

The mouth of a snake is marvelously adapted to swallowing large prey. The lower jaw is attached to the upper jaw by means of elastic ligaments, and each side



The mouth of this western boa is stretched enormously in an attempt to swallow a dead chick.

of both jaws is attached to the other by elastic ligaments. A snake can move the four sections of its jaws independently. It can also move the upper and lower jaws apart to permit passage of prey several times the size of its own head. The throat muscles are also elastic, which eases the swallowing of large prey.

When a snake swallows its food, it literally pulls itself over it. The teeth of a garter snake, for example, are needle sharp and point backwards. When a garter snake seizes a frog, its slanting teeth keep the frog from pulling away. Then with a series of jaw movements, the snake slowly moves its mouth forward on the prey, alternately hooking the teeth of one side solidly into it, then advancing the other side. In this manner it literally pulls itself right over its food. Watch how a garter snake or another small pet snake eats. Can you see how efficient its jaw are in swallowing large morsels?

Poison Apparatus

In addition to normal teeth that help in holding and swallowing prey, poisonous snakes have hollow fangs through which they can inject poison into their prey. When snakes such as the rattlesnake, the water moccasin, and the copperhead open their jaws wide, the bones of the head turn out the two long fangs in the upper jaw. Then, with the mouth wide open, the snake bites hard on its prey. The poison in a sac at the base of the fangs is squeezed out into the body of the bitten animal. When the snake releases its hold and closes its mouth again, the poison apparatus retracts into the upper jaw where it is out of the way.

The fangs of the tiny but very poisonous coral snake are fixed and are not enlarged. The snake bites with these, but since they cannot penetrate deeply the snake resorts to repeated biting and chewing, thus injecting the poison well. Fortunately the coral snake venom is injected only in small amounts because the snake itself is small.

Tongue

A snake's tongue is not a stinging organ. Rather, it is a sensitive, feathery-soft, taste and smell organ. When a snake flicks out its tongue, it is tasting the air. Its forked tongue darts out, traps some particles of air, and transfers them to two small pockets inside its mouth. There the particles are smelled by the snake much as we would use our noses to smell for odors around us, or as a dog would sniff the air to interpret the smells that come to him.

When you are close to a pet snake whose tongue is darting out, put your finger tip close to it. Can you feel it? Probably not, because the tongue is so slender and soft. Even baby snakes that have not left their eggs use their tongues. The cover picture shows a baby king snake that tasted the new air outside the egg several times before it ventured

to leave its snug, but confining leathery egg shell.

Eyes

Snakes probably do not depend upon their eyes so much as they do their sense of smell. Their eyes have no eyelids, so the snakes that seem to stare just cannot help it. You would stare, too, if you could not blink! Their eyes seem to be much better suited to observing nearby objects than distant objects. Many snakes, have good vision at short distances.

The pupils of most snakes' eyes are round like our own. Some snakes, however, have an elliptical pupil like a cat's. Among these are the non-poisonous boas and the poisonous rattlesnakes, copperheads and water moccasins. Elliptical pupils usually indicate nocturnal habits. Some scientists believe that an elliptical pupil can be closed more efficiently in strong light. Many snakes whose habits are nocturnal and most snakes that you will study have round pupils, however.

Ears

Snakes do not have ears, and cannot hear sounds as we do. Because they usually lie on the ground, however, they can detect vibrations such as a heavy animal walking, or an object striking the ground. The pictures that show Indian snake charmers give the false impression that the snakes are held in a spell by the weird music. If snakes cannot hear music, however, can a charmer really charm a snake with his flute?

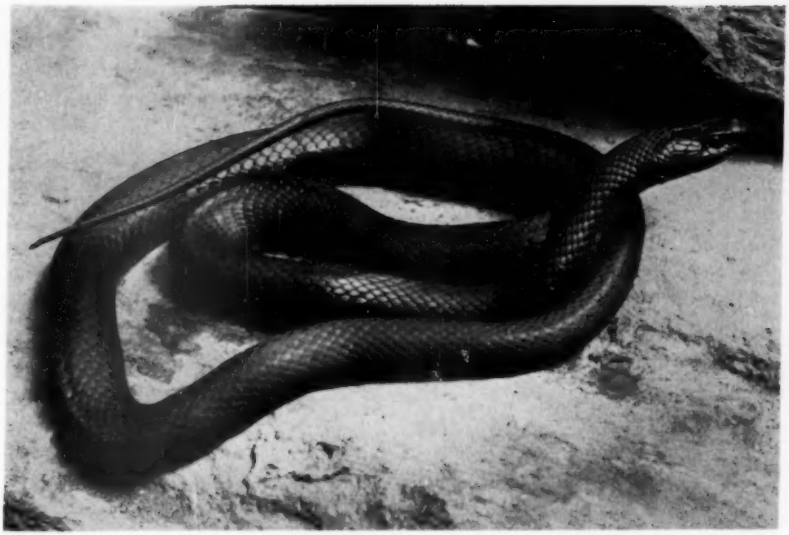
The mouth of this milk snake extends far back of its nostril and the unblinking eye.

Tails

A snake's tail begins just behind the anus. If you look at the underside of most small harmless snakes, you will see that the narrow, long belly scales are in a single row up to the vent (anus). From there to the tip of the tail they are frequently in two rows that meet in the center of the underside.

Snakes' tails are completely harmless. Some snakes such as the black racer and the milk snake may vibrate the tips of their tails when annoyed, but this is only a nervous reaction. They cannot cause injury, although the harmless worm snake would make you think so, the way it presses its hardened tail against your hand. Rattlesnakes, of course, do have a specialized tail with rattles that buzz when the tail is vibrated from side to side.

Snakes should not be held by their tails because most of them



The black racer or black snake is one of the longest and most agile snakes in the northeastern states. It is not the same as a pilot black snake.

reaching a length of a little more than thirty feet. Longer snakes are reported, but the only tangible evidence of these giants is the skin, which stretches considerably in the skinning process.

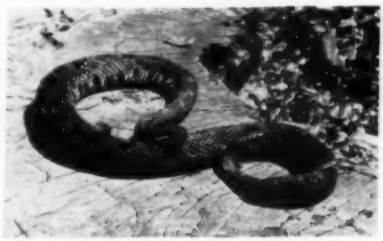
In South America, the anaconda is undoubtedly the largest snake, and in weight alone may be the world champion. It frequents stream banks where it lies in wait for small animals that come to drink. Even though it may lie in the water, it is not a particularly good swimmer, and prefers to catch its food near the shore.

Most of the snakes of the United States are less than five feet long. The longest snake in our country is probably the pilot black snake. It grows to a length of eight feet or more. An eastern diamondback rattlesnake may be nearly as long, and because of its heavier body may outweigh the black snake. Most of our snakes, however, are much smaller. The average length of all the snakes around your home or school probably would be less than three feet. The common deKay's snake seldom exceeds a foot in length. The beautiful, shiny gray ring-necked snake is only about a foot in length. The equally beautiful, smooth green snake is about the same length. Water snakes are often nearly twice this length, but the shy worm snake averages only about nine inches long. The young of these snakes are only a few inches

will wiggle violently, and the tail might break. If you hold a snake somewhat loosely in your hand, with the forward part of the body supported in one hand and the hind part by the other hand, the snake will reduce its struggling. If it insists on crawling forward, shift your hands by letting go with the hand supporting the hind section and putting it under the forward section. Restricting a snake's movement by gripping it tightly only makes it struggle more, and may make it bite.

Nostrils

The sense of smell is well developed in most snakes. It is known that some snakes can follow their prey as a hunting dog would track a rabbit. They may use both their nostrils and their tongues to test the odors on the ground and in the air close to the ground. A poisonous snake may bite a rat or a rabbit, for example, but not follow it immediately. In a little while, after the poison has taken effect, the snake will follow the trail of its prey until it comes upon the dead animal. Contrary to some notions, snakes do not stalk humans any more than a wild deer would stalk a human. It is as natural for a snake to hurry away from a human as it is for a mouse to hurry away. Of course, if you see the snake before it sees you, then it may appear to be headed toward you. Rarely, if ever, will a snake continue toward you unless its obvious escape route lies in that direction.



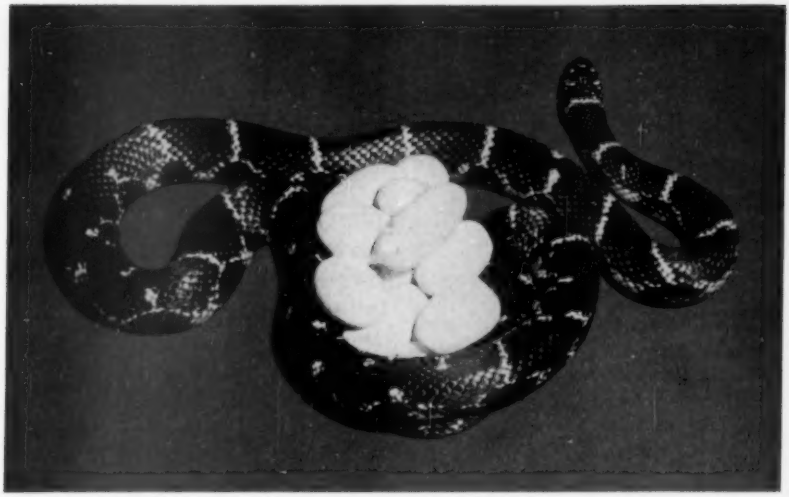
The uncommon massasauga or pigmy rattler is a pit viper that is restricted to swampy areas near the Great Lakes. Other species are found west and south of the Lakes.

Pits

Some snakes such as the rattlesnake are called pit vipers. This name comes from the two nostril-like pits that are located between the eyes and the nostrils. These pits contain heat-sensitive nerves. Experiments with rattlesnakes and other pit vipers have shown that these pits seem to help in directing a strike toward a warm-blooded prey. Even in a totally dark room rattlesnakes have struck quite accurately toward a cloth-covered light bulb when it was brought near.

Size

When someone hears the words "boa constrictor," he thinks of an enormously long snake that crushes its food to death. Actually, most boa constrictors do not exceed ten feet in length. The largest of all snakes is probably the regal python,



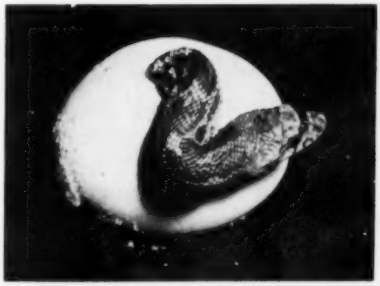
This female king snake laid eleven white eggs in June. One of her hatchlings is shown on the cover.

ger than a pencil. It is amusing to watch a tiny, harmless snake defend itself against an inquisitive finger.

Live-bearing snakes (called *viviparous)* often produce more young than egg-laying snakes. The garter snake, for example, produces as many as 75 young, and the water snake has been known to produce nearly as many. Most of the viviparous snakes, however, have litters of from 10 to 20 young.

Young viviparous snakes are colorful miniatures of their parents. They are born in a transparent sac that is uually ruptured at birth, allowing the young snakes to crawl away almost at once. The parent rarely offers any measure of protection to the young; instead, they soon go their separate ways.

A gravid female snake (one with unborn young) that is accidentally killed and opened will show a number of young inside. This has given rise to the common fallacy that some snakes swallow their young



This pine snake is on its way out of an egg. All fifteen inches of snake will come out of an egg that is only about two inches long.

in length and are smaller than a pencil.

When you see a snake in the field and wish to keep a record of its size, be conservative in your estimates of length and diameter, for it is known that these reptiles grow tremendously in memory. A man who saw a pilot blacksnake that was about five feet long and an inch and a half in diameter later described it as being eight feet long and as big around as his arm!

HABITS OF SNAKES

Reproduction

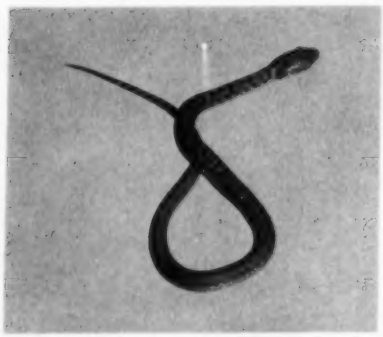
As with all animals, snakes must reproduce if they are to maintain themselves. In our country, most snakes are egg-layers. The eggs of snakes are usually oval, white or creamy colored, with a shell that is soft and leathery instead of hard and brittle like a bird's egg. Depending upon the species, egg-laying snakes (called *oviparous* by scientists) may lay from two to more than a hundred eggs. The king snake shown on the cover was one of eleven eggs laid by a captive adult. Milk snakes lay about a dozen eggs, racers may lay up to 25 eggs, the hog-nosed snake up to 40 (average about 25), and the mud snakes are reported to lay as many as 100 eggs; but most egg-laying snakes deposit only a dozen or so.

Egg-laying snakes usually select a pile of debris such as rotted leaves, manure, a decaying stump or log, or a sand bank in which to deposit their eggs. The eggs are laid in a cluster and often stick together. After being laid, they may swell slightly by absorbing some moisture from their damp surroundings.

Once the eggs are laid, the parent snake leaves and does not return to them. The young snakes must forage for themselves at birth. Only a very few snakes such as the python remain with their eggs after laying.

Just as baby birds have an egg tooth for breaking through their shells, young snakes have an egg tooth to help them. After several weeks have passed, each baby snake slits the leathery egg shell. As the egg is opened, the young snake may stick out its head to taste the air with its tongue. A young snake usually takes from several minutes to an hour or more before it ventures to leave its leathery cage. When it does, a surprising amount of snake slithers out of a relatively small egg. An egg not much larger than an elongated ping-pong ball may hold more than a foot of young snake!

A baby snake may eat very soon after hatching, and shed its skin within a day or two. In the case of poisonous snakes, the young have fully developed fangs and poison glands at hatching, although their small size makes them less dangerous than the adults. Even newly hatched baby black snakes are aggressive like their parents. Young milk snakes show little or no fear of humans at hatching, even though the snakes are scarcely big-



The young of some snakes are often colored differently from the adults. Compare this young garter snake with its parent on page 15.

to protect them. Such a feat is impossible, because the digestive juices of the adult would soon kill any young snakes that it swallowed. If the digestive juices did not kill the young, then the muscle action that proceeds from mouth to anus would make it impossible for the young ever to escape. One well known herpetologist offered a sizable reward for proof that a snake swallowed its young to protect them. No one has collected the reward.

Feeding Habits

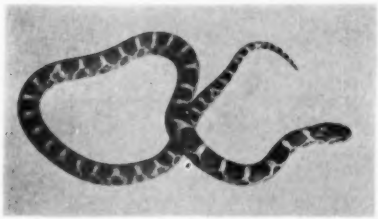
The feeding habits of our native snakes are almost as varied as the snakes themselves. Many of the snakes such as the common garter snake grasp their prey with their backward curved teeth, work their jaws round the food and swallow it whole. When a garter snake swallows an earthworm, the process may be quite rapid—almost like a child swallowing a string of spaghetti. On the other hand, swallowing a mouse might take a half hour or more.

When a snake eats a big meal, it may refuse more food for several days, but several bits of smaller prey may be needed to make a single meal. A pet water snake once ate nearly a dozen frog tadpoles within a few minutes, but a large frog satisfied the same snake for two whole days.

Snakes may refuse to eat entirely when in captivity. Then they must either be released, or force fed. A pet king snake was force fed with bits of meat and small mealworms until it would take food by itself. This practice is not to be encouraged, however, because a snake's mouth can be damaged easily by trying to force food between its jaws.

Some snakes are extremely choosy about the kind of food they will eat. A pet red-bellied snake would eat only slugs. It refused earthworms. A captive black snake refused meadow mice time and time again, but readily accepted live bats that were trapped in a summer cottage. When the supply of bats was exhausted, the snake refused to eat and finally had to be released. Out of captivity, it undoubtedly would have eaten the mice.

Although many snakes seize their prey and swallow it alive, one group of snakes constricts its prey by wrapping several coils about it



Milk snakes are aggressive and sometimes bite when first caught, but these native constrictors tame easily in captivity.

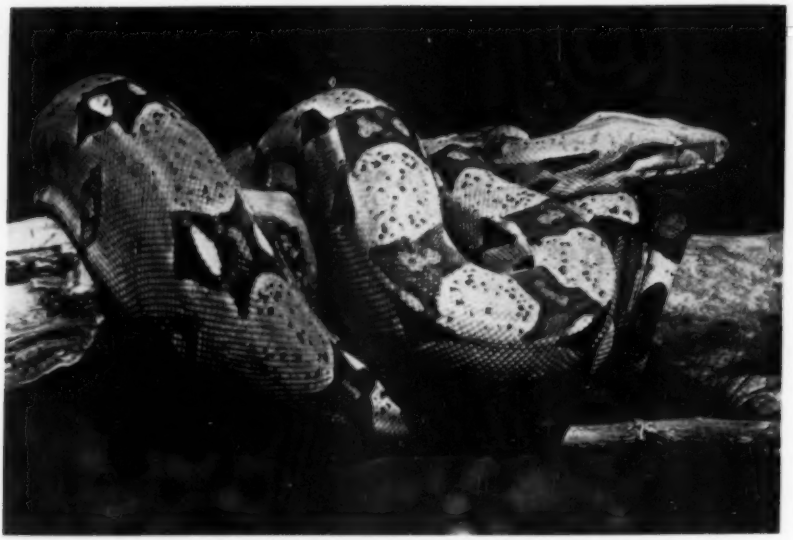
and squeezing it to death. Constrictors do not crush their prey as many persons believe, but only constrict the breathing and heart action of the prey so that it dies rather quickly. Then constrictors swallow their lifeless prey just as non-constrictors would.

The king snakes, including the milk snakes, are well-known constrictors of the United States. King snakes often catch and eat other snakes. The venom of poisonous snakes appears to be ineffective against king snakes, so they can subdue and eat rattlesnakes, copperheads and water moccasins. They probably do not distinguish between poisonous and non-poisonous snakes, however, but eat whatever happens to be at hand. A friend of mine once had a beautiful coastal milk snake in the same cage with a common milk snake. One day he glanced at the cage just in time to see the last of the tail of his lovely coastal milk snake disappearing through the mouth of the hungry milk snake.

Constrictors, especially some of the tropical constrictors, are as graceful as they are strong. The boa constrictors can move about an arm or branch of a tree with such grace and ease that it seems almost to flow. A friend's boa constrictor would wrap itself about his arm and remain there for minutes without any perceptible movement. Apparently it liked the warmth of its perch. It seemed so soft and gentle, but trying to remove it met with amazing resistance. It was as strong as it was soft and graceful.

In spite of their strength and their constricting habits, the king snakes are a gentle group. They make ideal pets. The biggest problem in keeping them is that of feeding, because most prefer live food to dead. Occasionally two hungry snakes will grasp a single piece of food and begin their swallowing process. Because their teeth point backwards, it is difficult for them to release their hold on the prey. Two garter snakes once seized opposite ends of the same earthworm. When they were found, the larger had worked its way up to and over the head of the smaller! The smaller snake apparently could not release its hold on the worm and was headed in the same direction as the worm!

The poisonous snakes use their venom to subdue prey before eating it. The venom is fast acting and often renders the prey helpless before it has moved very far from the snake. Many poisonous snakes feed



This powerful but gentle tropical boa constrictor loved to wind its coils around a branch and bask in the sun.

almost entirely on rodents and other small mammals. Although they are notorious because of their poison, bites to humans in our country are very uncommon. These snakes probably do far more good than harm except when humans interfere with them.

As a rule, snakes are not limited to one kind of food, but may eat a variety of animal life. A water snake, for example, may feed on fish, frogs, crayfish, aquatic insects, tadpoles, salamanders, and occasional mice and shrews. The garter snake has nearly as wide a range of foods, including earthworms, frogs, toads and salamanders. Occasionally it also eats insects and small mammals.

Some snakes, however, have distinct food favorites. The red-bellied snake feeds almost exclusively on slugs. The hog-nosed snake is said by some to have a distinct preference for toads. The smooth green snake, a beautiful and gentle creature, limits its food to insects. The tiny, secretive worm snake feeds mainly on earthworms. If you have a snake in captivity, keep a record of what it eats and how often it eats. Your record may reveal some unusual eating habits, and may also help you to advise others who wish to keep snakes for study.

In addition to food, snakes need water, which they often drink in quantity, gulping it as a horse would. A captive snake once es-

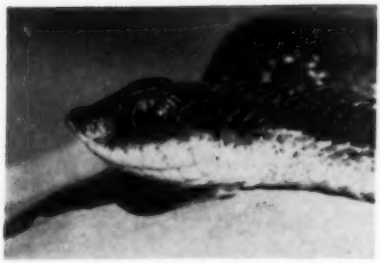
The garter snake is one of our most common snakes. Like other snakes having keeled scales, it produces living young.

caped in a classroom. It was not found for several days, during which time it had neither eaten nor drunk. When it was returned to the cage, it drank nearly all of a small dish of water. Its need for water was far greater than its need for food. Captive snakes may lie coiled in a water dish for long periods of time, especially before shedding. Perhaps they feel a need for moistening their dry skins, especially in rooms where the humidity is low. For this reason, a water dish should be large enough to accommodate at least part of the snake's body. The water should be changed frequently to prevent fouling.

The common water snake is aggressive, but it is non-poisonous. It should not be confused with a water moccasin which is not found in the Northeast.

Interesting Habits of Snakes

As you study snakes, you will find that they are as fascinating in their habits as they are in their structure and adaptation to crawling. Most snakes will crawl away or hide under objects to escape their would-be captors. The hog-nosed snake, however, is a bluffer. It often hisses, spreads its head, flattens itself to the ground, opens its mouth, and



This up-turned nose belongs to the hog-nosed snake. It is an accomplished bluffer when danger threatens.

generally acts like the most venomous, hideous, dangerous animal in the world. If this fails to scare off the danger, it rolls over on its back and pretends to be lifeless. If it is picked up and placed on its belly, it rolls over on its back again! All this display of ferocity and the feigning of death is effective for those who do not know that the hog-nosed snake is absolutely harmless. In captivity, it becomes quite tame and makes a good pet.

The little red-bellied snake has a habit that you must look carefully to observe. When you catch one, hold it gently with one hand behind its head, and watch its mouth. Can you see it curl its lips, just as a dog might when snarling? Of course, you cannot interpret this as snarling, but if the snake were large and you were small, you might not be so amused. After the snake has been in captivity for a while, it loses this interesting habit.

Some snakes vary their diet of small animals with occasional birds eggs. The gopher snake has projections from its neck vertebrae that press on the eggs and break them. Then the snake swallows the contents of the eggs, and regurgitates the bits of shell.

Bull snakes, found in the midwest, are fond of destructive rodents. They are valuable to farmers whose crops are damaged by rodents. The bull snakes sometimes trap rats in their tunnels, pinning them against the sides of their burrows to prevent their escape.

Black snakes, found in hilly and wooded areas of eastern United States from New York State southward, often hibernate with rattlesnakes. This has led to the false notion that the pilot blacksnake leads the rattlesnakes to safety or to the dens in which they hibernate. Pilot blacksnakes are slender, powerful constrictors. They can climb small trees with ease. One blacksnake is reported to have lived for some time between the walls of a house, feeding on the bats that rested there.

Hibernation

Snakes are called cold-blooded because they cannot control their body temperatures as we do. Instead, their body temperature approximates that of their surroundings. The activity of a snake is dependent upon its temperature. A cold snake, like chilled fingers, cannot move rapidly. In fact, a snake whose temperature is near freezing

is practically helpless. For this reason, snakes usually den up, or hibernate, in the fall before the temperature drops so low that it interferes with the snakes' activity.

Snakes hibernate in deep crevices in rocky ledges, in woodchuck holes, at the bases of hollow stumps, or almost anywhere below the frost line where they can be protected from the cold. A power shovel unearthed a mass of hibernating garter snakes in an abandoned water tower foundation. It was early spring and daytime temperatures had not yet risen to comfortable levels. There must have been at least thirty snakes hibernating in a cavity between the stones of the foundation.

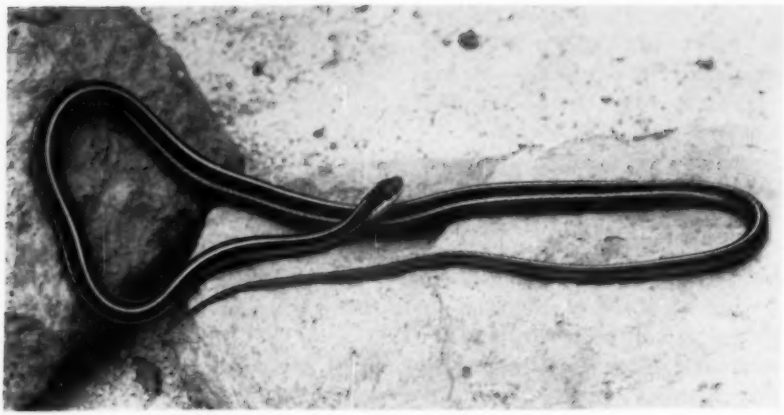
Another time a class observed no fewer than fifty harmless snakes with their heads protruding from an expansion joint where an abandoned roadway met a concrete bridge. Apparently there were numerous spaces in the rock fill under the approach to the bridge. Here was a safe retreat from the winter. The spring sun that invited the class on the field trip also coaxed the snakes from hibernation.

Cold interferes with a snake's normal activities, but too much heat is equally harmful. Snakes cannot endure prolonged temperatures much above 100° F. For this reason, many desert snakes are seldom seen in the daytime. Desert rattlesnakes are mostly nocturnal, prowling about in search of warm-blooded prey after the desert has cooled sufficiently to prevent their suffering from the hot soil underneath them. The vertical pupils of their eyes also indicate this nocturnal habit.

When cold weather comes in the fall, or when occasional cold days linger in the spring, snakes often can be found lying under a flat stone where they are protected from the cold air, but can feel the warmth of the sun. Look for them on a south-facing bank. To find snakes in fields or along banks, carefully turn over large flat stones, but remember to replace them for they represent places of retreat for many kinds of small animals.

Some snakes, even though they are non-poisonous, may attempt to bite when picked up. The milk snake may attempt to bite, but its teeth are as short as they are sharp,

The ring-necked snake can be identified by its gray body and striking yellow ring. It is a native of the eastern states, with relatives in the South and West.



The slender, colorful ribbon snake inhabits lowlands and wet meadows where it feeds on small cold-blooded vertebrates and on insects.

and cannot inflict much damage. Garter snakes, black snakes, king snakes, and water snakes often nip their captors at first, but frequently settle down and become quite docile in captivity. A five-year-old held a freshly captured blacksnake in her hands without its attempting to bite. Of course it wiggled, but almost any wild animal would do so in an attempt to free itself.

Some fascinating, attractive snakes that New York State children should learn about are the deKay's snake, garter snake, red-bellied snake, milk snake, green snake, ring-necked snake, and ribbon snake. You can find descriptions of these in many books, and all of them can be released safely in the vicinity of your school if they cannot be persuaded to eat in captivity.

Remember that almost all the snakes you will see in the northeast are not only harmless, but may be actually beneficial. If you try to understand how snakes live and what they are like, you will find that they are worth your study and will reward you with many moments of pleasure.

LIZARDS

CHARACTERISTICS

The most obvious difference between lizards and snakes is that lizards have legs. These legs are tipped with claws that make climbing easy for many lizards. There are other, less obvious differences between lizards and snakes. Most native lizards have eyelids and can blink their eyes. Snakes must stare

because they cannot blink. Lizards have ears and can hear; snakes cannot. Only a few lizards are live-bearing. Many snakes, including some of the most common, are live-bearing. Only two species of lizards are poisonous; many species of snakes are poisonous. Lizards are usually much shorter and have stouter bodies than snakes. Both lizards and snakes, however, have similar scaly skins, they are cold-blooded, and their eggs are leathery.

Skin

Lizards' skins, like snakes' skins, must be shed periodically. A snake sheds its skin in one piece, but the skin of a lizard usually sloughs off in small pieces. When a lizard is shedding its skin, it looks diseased. If lizards could sunburn, you might think one was peeling after having blistered.

Some fine-scaled lizards such as the geckos, shed their skin in nearly a single piece. Coarser scaled lizards, however, shed skin at different times on different parts of their bodies. This gives the creature a patchy appearance.

Snakes do not eat their skins after shedding, but lizards often eat pieces of the shedding skin. Sometimes a lizard will pull off a piece of loosened skin and eat it, but more often it will rub the loosened sections against a stone or a piece of bark.

A few lizards such as the horned lizard (popularly called a horned toad, although it is not an amphibian) have grotesque outgrowths of some scales. No doubt these horns are of some protective value to the lizard, but they are harmless to anyone handling one of these lizards unless the creature moves quickly and a pointed horn jabs your hand.

The formidable appearance of this horned lizard belies its gentle disposition.

Jaws

Lizards crunch their food a few times, then swallow it in gulps. Because most lizards do not capture large prey, but subsist mainly on insects, they do not have jaws that stretch apart to accommodate food larger than their own heads.

Lizards have numerous, stout teeth that are short but sharp. They do not slant back to prevent the escape of prey as in snakes. Instead, they are used for crushing food before swallowing. The jaws and teeth of even small lizards are strong. You can hear them crunch the exoskeleton of small insects before they are swallowed. Sometimes a newly captured lizard will

nip a hand. Native New York State lizards pinch, but cannot injure the skin. Their teeth are too short and their jaws too small to cause injury. Some larger western lizards are pugnacious and will nip with considerable force, but often become tame and gentle in captivity.

In only one native lizard are there any poison glands in the mouth. The Gila monster, a lizard of the southwest, has poison glands, but its teeth are not hollow like the poison fangs of some snakes.

Tongue

Some lizards have forked tongues like snakes; others do not. The tongue is used for testing the air, as snakes do, but it is also used for tasting food. Lizards are slow to flick out their tongues, but snakes use theirs frequently.

Lizards often use their tongues to lap up water. You can watch captive skinks lap the water from droplets squirted into the cage. Snakes, on the other hand, usually gulp water from a dish.

Eyes

Lizards depend upon their eyes perhaps even more than snakes do. Their eyes will follow every movement of insect prey. Some lizards can move each eye independently of the other. It is comical to see a lizard with one eye looking forward and the other backward!

Most lizards have eyelids that can completely cover the eye. When a lizard suns itself with its eyes closed, it may appear dead, but if danger threatens it will suddenly come to life and dash away, eyes wide open and alert. Even when its eyes are closed, remember that it can hear nearby sounds.

Eyelids and an ear opening are both clearly visible on the head of this lizard. Compare with the head of the milk snake shown on page 6.

The eyes of a few lizards such as the horned lizard are peculiar because they sometimes squirt blood! These lizards are able to increase greatly the blood pressure in their heads. The membranes of the eye are so thin that when the blood pressure becomes sufficiently high, some of the blood may be ejected in a tiny stream. Usually, however, this controllable blood pressure is used to swell parts of the head to aid in loosening the old epidermis.

The pupils of most diurnal lizards are round, but in nocturnal lizards they are frequently vertical. The dainty, tree-climbing geckos are nocturnal creatures whose pupils are vertical slits in daylight, but dilate to become large and round in the dark.

Ears

If you try to stalk a coal skink, you will learn that it can hear you long before it sees you. The ears of lizards are fairly sensitive and help to distinguish these creatures from their deaf relatives, the snakes. In some burrowing lizards, however, the ears have disappeared. In a few, the ear seems to be absent because a flap of skin covers it.

Tails

In most lizards the tail is at least as long as the body, and in some it is three times as long. Occasionally you may find a lizard with a short, blunt tail instead of a long tapering one. This short tail is probably a regenerated tail, for lizards have the ability to grow new tails if they lose the old ones!

In some lizards the tail separates from the body easily if it is grasped by an enemy. Cartilage grows to replace the vertebrae and a new, stubby tail replaces the original. It has been suggested that some lizards can actually break off their own tails if danger threatens, but this is questionable. They do break easily, however, and in some species a wriggling tail may distract an enemy long enough to let its former owner escape.

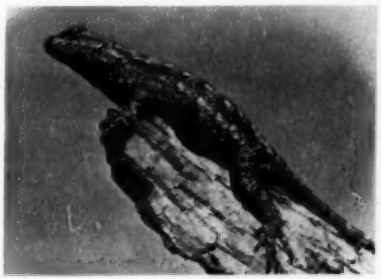
The tail is important as a balancer to some lizards like the western collared lizard that can run on its hind legs alone. When running upright, it looks like a miniature dinosaur.

Legs

Most, but not all, of our native lizards have legs. Those with legs usually have claws at the tips of their toes. The claws are sharp and enable lizards such as fence lizards to climb trees readily. Other lizards of the Southwest clamber over rocks with ease. Two groups of eastern lizards, the geckos and the anoles, have enlarged friction pads near the tips of their toes to help them climb trees.

Lizards can run very fast—much faster than snakes can move. The coal skink, found in western and southern New York State and south through the Appalachians, can scramble through the leaves and twigs of its woody habitat so fast that it is difficult to catch. One speed champion, the gridiron-tailed lizard of southern California, can run about fifteen miles an hour, or several times as fast as the fastest snake can travel.

When you lift a newly captured lizard from a cage for examination,



The fence lizard, one of the most common in the East, is a good climber. It makes a fine classroom pet, too.

be careful that it does not get away from you. These appealing reptiles will often lie motionless, then suddenly dash away at top speed.

Size

Most lizards of the eastern United States average only a few inches in length. Fence lizards and coal skinks may be only four or five inches long when fully grown. Some lizards, however, may grow to a length of more than a foot. The Gila monster of the Southwest sometimes reaches a length of nearly two feet. The glass-snake lizard of our Southeast may reach a length of three feet, although it is much more slender than most lizards. In other parts of the world there are even larger lizards, but our own are mostly small and harmless. Alligators, remember, are not really lizards; they bear only reptilian resemblance to their small terrestrial cousins.

HABITS OF LIZARDS

Reproduction

Nearly all the lizards in this country are egg layers. Their eggs, like those of snakes, are white, oval and usually leathery. Below is shown a coal skink with its seven eggs. It made its nest in a slight depression under a piece of fallen tree bark. As the picture of the coal skink nest shows, lizards often incubate their eggs. When the young lizards hatch, they open the leathery shell with the help of an egg tooth that is similar to the egg tooth of a young bird.

Before mating, some lizards and snakes perform interesting courtships. You may observe some of the

This female coal skink was found with her eggs in a shallow depression under a slab of fallen bark. Although they will nest in captivity, a nest in the wild is hard to find.

Notice the prominent dewlap on the male anole at the lower right. These lizards can change their colors, too, as shown in this picture.

peculiar motions that make up the courtship of reptiles, if you keep a pair in captivity during the breeding season. Watch for unusual head bobbing, short dashes to and fro, or other attempts of a male to show off for his mate. You can often tell the male by his brighter colors, more slender body, and, in the anoles, by a throat flap that he may inflate at times.

Feeding habits

Insects make up most of the diet of lizards. Butterflies, moths, beetle larvae as well as adult beetles, and even dragonfly nymphs may be consumed in great quantity, showing that these terrestrial reptiles may forage along waterways for food. Lizards in captivity accept mealworms readily during winter months. A few even eat other lizards!

Although most eastern and midwestern lizards eat only insects, spiders, occasional sow-bugs, and similar small invertebrates, some western lizards eat flowers and seeds. The food that desert lizards eat provides them with the water they need. They do not drink water as do their mid-western and eastern relatives.

Lizards that live along the west coast often feed on the beetles that feed on dead animals. These shoreline lizards scoot across the sand to a decaying animal, probe around it for carrion beetles, then scoot back to shelter as quickly as they came.

The geckos and anoles of the southeastern states run quickly along tree branches in search of caterpillars, hoppers, and other insects that live there. One tree lizard of Africa, the true chameleon, extends a sticky tongue to trap insects that move within its range.

The horned lizard of the southern states moves slowly and does not climb trees. It prefers to sit in one spot and snap up ants as they run past.

When you feed captive lizards, watch carefully how they feed, how they follow their prey when it moves, and how they seize it eagerly and swallow it. By keeping a record of the kinds of food a pet eats, you may find that these scaly insectivores are really beneficial animals.

Other Interesting Habits of Lizards

The chuckwalla, a large lizard from the arid Southwest, has a curious habit of seeking shelter in a rocky crevice and then inflating itself so it cannot be pulled from its

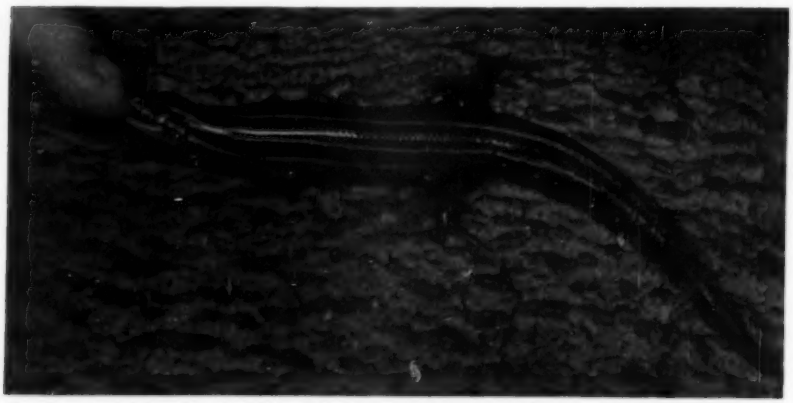
retreat. To inflate, it gulps air until its body is pressed tightly against the rocks. This same lizard feeds on plant material in contrast to most of its insect-eating relatives.

The horned lizards of the southwestern states use their horns to help defend themselves against predators such as snakes. They often swell their bodies as a further deterrent to would-be predators. Occasionally a snake does eat one of these spiny lizards, but it risks being impaled from within by the lizard that it swallowed.

The collared lizard, an aggressive creature, sometimes turns cannibal. It should not be caged with other lizards because it may use its cage-mates for food. This handsome lizard is so pugnacious that it has been reported to react in a threatening manner to a passing train! Of course, its small size and its nonpoisonous nature make injuries from it slight, but it can pinch hard enough to warrant caution in handling.

Some male lizards have highly colored body parts that they use to threaten other males or perhaps to attract females. The male anole can extend a colorful fold of skin (dewlap) under its neck. This dewlap, which stretches from the chin to the throat, is bright orange or even reddish in color. When a male wishes to display his dewlap, he holds his head up high, straightens out his front feet, and exposes the fold. Sometimes these creatures engage in a bobbing that serves to make the fold more attractive then ever.

Heat is an important problem for many lizards, especially those that live in desert areas. Because they, like snakes, cannot control their body temperatures, they are nearly at the mercy of the sun and soil. Some avoid the scorching sand



The harmless five-lined skink, like some other lizards, may nip a finger when molested, but they are too small to cause injury.

surface by elevating the body with stiffened legs. Others often seek shelter from the intense sunlight by burrowing in the soil, or by hiding under stones or in crevices. Even though the surface of desert soil may be extremely hot, a few inches down it may be comfortably cool. After the sun goes down, these burrowing lizards leave their cool retreat to hunt for food.

When desert lizards hunt in the daytime, they are very active, often running from rock to rock, but pausing in the shade of one long enough to keep from becoming overheated. Experiments with some desert forms have shown that they can cool their bodies slightly by evaporating from their lungs some of the water formed from their food.

Light colored lizards reflect more of the sun's rays than dark ones. Eastern lizards such as the coal skink, the five-lined skink, and the fence lizard, are dark colored. The sandy coloring of some western desert lizards may be a protective adaptation to life in the bright, hot sun.

Hibernation

Lizards must hibernate to escape the cold of winter just as snakes do. Some hibernate by digging down in the soil. Some find retreats in deep crevices in rocks. Others may hibernate in the recesses of an old stump, in a stone pile, under masses of leaves, or in the foundation of a building. There they spend the winter months. When the spring sun again warms the air and the soil they venture forth to mate, lay eggs, and continue their energetic scamperings for food.

TURTLES

CHARACTERISTICS

In outward appearance, turtles bear little resemblance to their snake and lizard relatives. Their bony shells make them distinctive among reptiles. Millions of years ago, while dinosaurs still roamed the earth, turtles developed this strange protection and have changed it little since that time.

Turtles resemble their scaly relatives in that they lay leathery eggs, they are cold blooded and they have lungs. There the resemblance stops, and turtles show characteristics shared by few other vertebrates. Turtles have no teeth, many can withdraw into their bony shell where they are well protected from danger, they live to ripe old ages, their eyesight is excellent, even at a distance, and although they have no gills, many of them can breathe under water.

No turtles are poisonous, but some have dispositions and jaws that make it necessary to use caution when handling them. Only two in northeastern United States can

be considered dangerous. They are the snapping turtle and the soft-shelled turtle. The young of both make interesting pets, but as they grow larger, their jaws and temper grow more formidable.

Most turtles have gentle dispositions and make excellent reptiles for classroom study. Some, such as the box turtle, the wood turtle, the map turtle, and the painted turtle can be kept for several years in a cage with a water well provided for drinking or bathing. Even in a dry terrarium, these turtles can be removed daily for a soaking, then put back into their cages. (See *Keeping Animals In The Classroom*, Cornell Science Leaflet for September, 1959.)

Shell

Most turtles have a hard, bony shell whose top and bottom are connected by a bridge of bony material. The front legs and head extend from in front of this bridge, and the back legs and tail extend from behind the bridge. The upper, thicker part of the shell is called the *carapace*. In some turtles such as the soft-shelled turtle, it is soft and leathery. In most, however, it is thick and hard. It is made of bony plates that grow together to form a single hard cover. Over the bone grow shields of horny material that form a pattern of rectangles or tiles. These horny shields are no indication of the shape and number of bones that underlie them. It is the bones, not the shields, that make the carapace rigid.

The "annual rings" on the shell of this wood turtle give some indication of its age.

The horny shields that cover the top of the carapace are made of large scales that meet along definite lines. Each year a new, slightly larger scale grows under the old one. Unlike snakes and lizards, however, most turtles do not shed the scales each year. Instead, they accumulate to form irregular bumps or knobs, each composed of the scales from preceding years. If a turtle lost none of its scales during its life, you could tell a turtle's age by the rings formed by the layers (laminae) in the shields. Most turtles, however, lose some of these layers. In tropical species where hibernation does not interrupt growth, rings are not apparent. Turtles are like trees in this respect.

The underside of the shell is called the *plastron*. It is often smaller than the carapace, especially in the snapping turtle. In the box turtle and in Blanding's turtle, the plastron is hinged crossways so the animal can withdraw into its shell, then pull the plastron up to meet the carapace. This gives the animal

Note how the hinged plastron of this box turtle completely encloses the animal within the shell. Compare this with the solid plastron shown on page 31.

a close-fitting, bony armor to protect it against predators. Most turtles, however, can only withdraw into their shells.

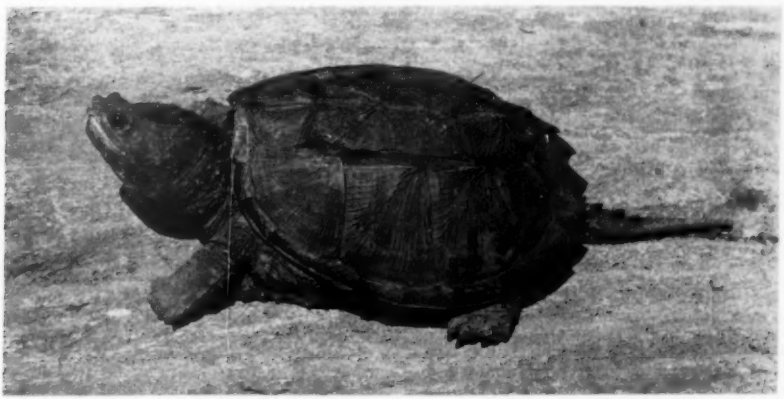
Skin

Snakes and lizards are obviously scaly creatures. Turtles are, too, but you may not think so at first glance. Their feet are scaly, particularly near the toes, and the head and tail usually are scaly. The body itself has lost most of its scales because they are not needed for protection. Instead, the carapace and the plastron have become covered with large scales that do not slough off as they do in other reptiles.

Jaws

Turtles have no teeth; instead, they have a hard ridge around each jaw. These ridges, made of material resembling fingernails, are sharp. They come together like snippers to grasp prey or to break off chunks of food before swallowing.

Most turtles use their jaws only for eating. The snapping turtle, however, can use its jaws effectively for defense. A large alligator snapper from the mid-southern states is said to be able to snap a broomstick in two with its jaws. Fortunately, these larger turtles live in



The snapping turtle cannot withdraw completely into its shell because it has a very small plastron. Its strong jaws and long neck offer good offensive protection, however.

the muddy bottoms of sluggish streams where they are rarely seen. In addition, they have much milder dispositions than their smaller aggressive cousin, the common snapping turtle.

Tongue

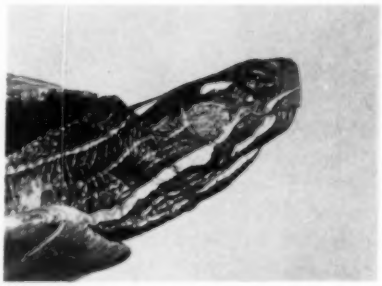
Most turtles' tongues, short and stout, are securely fastened to the floor of their mouths. The alligator snapping turtle, however, has a tongue with an unequally forked tip that can be wiggled like a worm. To catch fish, the alligator snapper will lie quietly on the bottom of a pond, open its mouth wide, and wiggle its curious bait. If a fish approaches to investigate, the snapper thrusts its head out with the speed of a striking snake and seizes the inquisitive prey.

No other turtle has such a unique fishing equipment. They must either lie in wait for prey to come near enough to be seized, or forage about for whatever carrion or living prey they can capture.

Eyes

Eyesight in turtles is well-developed as you could tell if you should try to approach painted turtles that are sunning. They can see objects both at a distance and nearby.

One scientist experimented with turtles' eyesight by marking pathways leading to food or an electric shock. He found that his turtles could distinguish between black and white and could also distinguish between narrow lines of varying width. Another scientist found that some turtles can distinguish between a few colors.



The painted turtle has excellent eyesight, often spotting slight movements across a big pond.

Turtles' eyes have a nictitating membrane similar to that in birds. This is like a thin shade that can be drawn across the eye. In addition, they have eyelids that can close outside the nictitating membrane.

Can you see how it would be possible to identify most reptiles as snakes, lizards, or turtles by their eyes alone?

Ears

Ears are not so well-developed in turtles as they are in lizards. Many turtles have a hearing apparatus, but it may not show externally. They seem to react to some sounds, but it is difficult to tell whether they hear the vibrations, or feel them with other parts of their bodies.

Some turtles have voices; at least they make soft noises that sound like turtle-talk. Perhaps many of these noises originate in the throat

in spite of the absence of vocal cords as we know them. Sea turtles are known to grunt or roar during mating, but the shy wood turtle makes only a soft musical tone. Keep a record of any sounds you hear from turtles because good records of their voices are scarce.

Other Senses

Turtles do not have a snake's keen sense of smell. They are able to locate their food under water by a combination of taste, smell and sight, but it is not known which of these is most important.

The sense of touch is locally well-developed in turtles, particularly in females selecting nest sites. The female can tell when the sand is moist enough for her eggs.

Some writers have ascribed a sixth sense to turtles—that of a premonition of height. Even though few turtles will blunder off a ledge, or fall into a well, it is doubtful if they possess any unnatural perception of depth or height.

Size and Age

Turtles vary in size from a few inches in length for a fully grown box turtle, painted turtle or map turtle to about eight feet for the giant, marine leatherneck turtle. Our local pond turtles may weigh as little as a few ounces at maturity. The estimated weight of the large leatherneck is nearly a ton! A big snapping turtle may weigh as much as eighty pounds, an alligator snapper more than two hundred pounds. These are the largest fresh water turtles in our country.

Some turtles grow to ripe old ages and outlive all other reptiles. The snapping turtle may reach an age of twenty or thirty years and the alligator snapping turtle has lived nearly sixty years in a zoo. The common box turtle is thought to live to an age of a hundred years or more under optimum conditions. Most turtles, however, do not live to such old ages. The box turtle that was found some years ago with "G. Washington, 1751" cut into its carapace was probably faked, but certainly the carver picked the longest-lived of our local species for his prank.

HABITS OF TURTLES

Reproduction

Turtles lay their eggs in sand, loose soil, or in piles of organic debris. They may lay up to more than a hundred eggs, depending on the species. The snapping turtle is known to lay as many as 75 eggs at a time, although the average number is probably nearer two dozen. The common painted turtle lays only a half dozen or so at a time. The gopher tortoise that lives in the arid Southwest may lay even fewer eggs. One African turtle is said to lay a single egg.

When a female has mated and is ready to lay eggs, she selects a sandy spot, or one that suits her, and proceeds to excavate a shallow hole with her hind legs. Sometimes she

moistens the soil with fluid from her bladder, either to make digging easier or to moisten the soil around the eggs.

Into the cavity she slowly drops the eggs, one at a time, arranging each with a hind leg as it falls. After the eggs are laid, she covers them with soil, using her hind feet again. When the eggs are covered, she wanders away and leaves them to hatch when they are ready—usually in about two or three months, although some pass the winter underground.

Often a turtle is so intent on the egg-laying process that it is hardly disturbed by onlookers. It is said that natives can approach some sea-turtles while they are laying eggs, and can actually catch the eggs in their hands without disturbing the turtles. These eggs are so highly prized as food that collecting them has seriously reduced the numbers of some species.

Feeding Habits

Most turtles that live in water eat a variety of foods such as fish, insects, tadpoles, snails, and a number of plant materials such as water lily seeds and duckweed. Wood turtles in captivity will thrive on earthworms and occasional bits of lettuce, banana or apple. In the wild, they eat insects, fish, tadpoles, algae, and many other materials.

Box turtles, like wood turtles, are omnivorous. A captive box turtle was fed for several years on earthworms, berries, apples, bananas, and

The carapace of the soft-shelled turtle may be soft, but its jaws are not!

occasional pieces of raw meat. Wild box turtles also eat fungi, insects, slugs and fruits of various plants.

The soft-shelled turtle often lies on the bottom of ponds or streams in wait for its food which consists mostly of crayfish, insects, fish, and snails. It also eats some plant food. Other small fresh water turtles have much the same diet, but prefer to forage for their food instead of lying in wait for it.

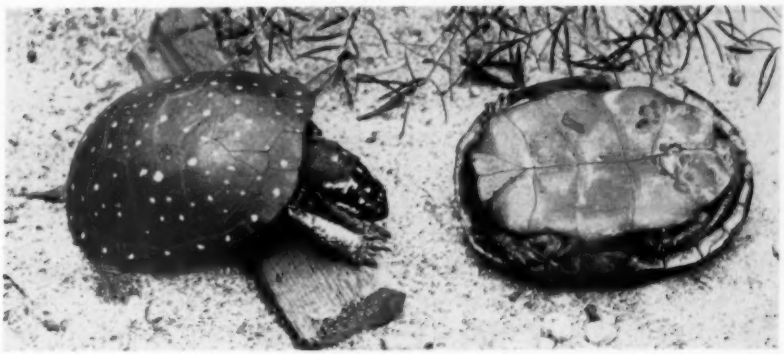
Snapping turtles feed largely upon fish. They temper their diet with crayfish, snails, carrion, and plant material. Some even eat young ducks and muskrats.

Interesting Habits of Turtles

Many species of turtles make interesting classroom or home pets. Often they will learn to beg for food, sometimes lifting their heads and shells so high that they stand on three legs as if to sit up. Gilbert White, an English nature writer, made a pet of a tortoise in his garden. For many years he watched the goings and comings of his beloved reptile. His writings about his turtle have become famous in natural history literature.

The gopher tortoise of the South digs burrows as long as twenty or thirty feet. These burrows are often shared by other reptiles such as rattlesnakes that do not bother the turtle that makes the hole.

The true land turtles (often called tortoises) such as the desert tortoise have hind feet that resemble elephants' feet. They are cylindrical and adapted to pushing across dry land. The fore-legs are modified for digging, since many of these land turtles live in burrows except when foraging for food. In arid regions, they have large bladders to accommodate quantities of body fluids that may have to be stored during the long time between showers. These arid land animals



The plastron of this spotted turtle is not hinged like that of the box turtle shown on page 27.

eat plant materials such as blossoms and grass rather than animal materials.

Sea turtles have legs modified for swimming. Some of the giant sea turtles move their flippers (modified front legs) up and down in order to fly through the water. Even though they spend most of their lives at sea, they still go up on sandy beaches to lay their eggs.

The most common turtle of the Northeast, the painted turtle, never wanders far from the water except to lay eggs. When it leaves its log, it can remain submerged for many minutes without a fresh air supply. Parts of its digestive tract are lined with blood vessels that help to extract oxygen from water sucked in and expelled.

The breathing of turtles is itself a remarkable operation, because their ribs are fastened tightly to a rigid shell. Unlike their vertebrate relatives, they use the muscles of the abdomen and other parts of their body to inflate their lungs. Even the musculature around their legs helps turtles breathe.

As you observe the turtles of your area, watch for some of the things you have read. Keep records of where you find them, where they nest if you happen to find one, and any other unusual observations you can make. Turtles make good soup, but they also make fine pets and excellent wild animals for observation. As you observe them, remember that their ancestry far outdates yours. If they seem content to lie in the sun and wait until food comes to them, do not think them brainless or shiftless. Perhaps it is just that they have found that it is the way to outlive their more restless vertebrate competitors.

SOME HELPFUL REFERENCES

For Teachers:

AMPHIBIANS AND REPTILES OF THE CHICAGO AREA, C. H. Pope, *Chicago Natural History Museum, 1947, 266 pages.* Fortunately, nearly all the animals described in this handy, non-technical guide to the reptiles of the Chicago area are found in New York State.

HANDBOOK OF LIZARDS, H. M. Smith, *Comstock, Ithaca, New York, 1946, 543 pages.* A comprehensive and thorough description, with keys, to the lizards of the United States. Includes 59 pages on lizard biology, classification, and historical study.

REPTILES AND AMPHIBIANS OF THE NORTHEASTERN STATES, Roger Conant, *Zoological Society of Philadelphia, Philadelphia, Pa., 1952, 40 pages.* An inexpensive, non-technical publication giving pictures and brief descriptions of the amphibians and reptiles of our area, with suggestions for keeping them in classrooms.

HANDBOOK OF SNAKES, A. H. Wright and Anna Wright, *Comstock, Ithaca, N. Y., 1957, two volumes, 1069 pages.* A thorough compilation of data on the habits, range, and specific field observations of United States snakes. Primarily for reference use.

HANDBOOK OF TURTLES, Archie Carr, *Comstock, Ithaca, N. Y., 1952, 529 pages.* A complete and informative text on the turtles of the United States and Canada. Includes numerous plates and drawings as well as keys and descriptive text.

FIELDBOOK OF SNAKES, K. P. Schmidt and D. D. Davis, *Putnam's Sons, New York, 1941, 354 pages.* A field guide to the snakes of the United States, with keys to species and comments on food, size, habits and range.

For Pupils:

ANIMALS IN ARMOUR, Clarence J. Hylander, *Macmillan, N. Y., 1954, 203 pages.* A general information book on the reptiles of North America, with black and white photographs of most of the species described. Upper.

THE BOOK OF REPTILES AND AMPHIBIANS, Michael H. Bevans, *Garden City, N. Y., 1956, 62 pages.* A colored picture guide to some of the more common reptiles and amphibians of the United States. A brief descriptive text accompanies each color plate. Intermediate, upper.

THE FIRST BOOK OF SNAKES, John Hoke, *Franklin Watts, N. Y., 1956, 68 pages.* A general account of snakes, rather than a book for identifying them. Includes sections on mythology, eating habits, locomotion, poisonous snakes, and snakes as pets. Intermediate.

REPTILES AND AMPHIBIANS, H. S. Zim, and H. M. Smith, *Simon and Schuster, N. Y., 1953, 153 pages.* This Golden Nature Guide accompanies each colored plate of a species with a brief description and a map showing its range. A good pocket guide. Upper.

REPTILES ROUND THE WORLD, Clifford H. Pope, *Knopf, N. Y., 1957, 194 pages.* A simplified treatment of reptilian biology is followed by sections describing the reptiles of various sections of the earth including structure, habits and history. Not a field-guide. Upper.

SNAKES OF THE NORTHEASTERN UNITED STATES, Clifford Pope, *N. Y. Zoological Society, New York 60, N. Y., 52 pages.* A well illustrated and informative booklet that is useful for both teacher and pupil. Identifies and gives simple life histories of common snakes of our area. Upper.

A CHECKLIST OF NEW YORK STATE REPTILES

Snakes

Copperhead (SE, extreme Southern Tier)*	*Agkistrodon contortrix*
Worm snake (SE)	*Carphophis amoenus*
Black racer	*Coluber constrictor*
Timber rattlesnake (Southern Tier, Hudson Valley)	*Crotalus horridus*
Ring-necked snake	*Diadophis punctatus*
Pilot black snake	*Elaphe obsoleta*
Hog-nosed snake (SE)	*Heterodon platyrhinos*
Milk snake	*Lampropeltis doliata*
Queen snake (W)	*Natrix septemvittata*
Water snake	*Natrix sipedon*
Rough green snake (SE)	*Opheodrys aestivus*
Smooth green snake	*Opheodrys vernalis*
Massasauga rattler (W, Lake Plain swamps)	*Sistrurus catenatus*
deKay's snake	*Storeria dekayi*
Red-bellied snake	*Storeria occipitomaculata*
Short-headed garter snake (SW)	*Thamnophis brachystoma*
Plains garter snake (Southern Tier)	*Thamnophis radix*
Ribbon snake	*Thamnophis sauritus*
Garter snake	*Thamnophis sirtalis*

Lizards

Coal skink (W, Southern Tier)	*Eumeces anthracinus*
Five-lined skink (SE)	*Eumeces fasciatus*
Fence lizard (SE)	*Sceloporus undulatus*

Turtles

Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Spotted turtle	*Clemmys guttata*
Wood turtle	*Clemmys insculpta*
Muhlenberg's turtle	*Clemmys muhlenbergi*
Blanding's turtle	*Emys blandingi*
Map turtle	*Graptemys geographica*
Mud turtle (Southern tier)	*Kinosternon subrubrum*
Diamondback terrapin (Salt marshes)	*Malaclemys terrapin*
Red-bellied (SE)	*Pseudemys rubriventris*
Musk turtle	*Sternotherus odoratus*
Box turtle	*Terrapene carolina*
Spiny soft-shell	*Trionyx ferox*

*Parenthetical sections refer to New York State only.